VENDOR INVOLVEMENT AND CONCURRENT ENGINEERING: METHODS IN REDUCING DEVELOPMENT TIME FOR NEW MODEL IN AUTOMOTIVE INDUSTRY

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Abstract

A study of method improvement to reduce development time for new model in automotive industry is presented in this paper. The approach taken is by studying the existing practice in car development. It was found that in the current practice of car development, project planning and master schedule were not officially endorsed by all related departmental heads, which resulted in too ambitious and unrealistic schedules. Other problem includes lack of comprehensive market research to gauge the car implementation timing, styling and manufacturing trend in the process of project planning. It was also found that benchmarking exercise was carried out on already released product and for future product. The study suggested various ways for method improvement such as through effective benchmarking process, audit of vendor capability, excellent computer facility, official endorsement of project planning and master schedule by related departmental heads and comprehensive market research.

Introduction

Automotive industry is one of the most important economic catalysts in every country. It creates direct and indirect industry covering almost all products of steel, rubber, plastics and electronics. The product development process for automotive industry is normally complicated, expensive, long and risky. A typical car project usually takes 25 to 48 months to complete with cost ranging from several hundred million to even billion of dollars. A typical automotive project would require direct and indirect human resources from many functional organizations and facilities such as internal manpower, vendors, consultants and partners spread across the country and throughout the world. Automotive project involves design, engineering, and manufacturing expert team in order to control timing, costs, delivery, regulations and customer needs. Obviously, producing a product as per planning intent is a daunting task and subject to tremendous risks.

Though various methods can be implemented in reducing development time for a new car, concurrent engineering is one of the important methods. Concurrent engineering integrates the roles of engineering, manufacturing, and marketing in bringing the products to market by sharing the information about problems at hand as well as recognize the customers'

expectations as they evolve (Sapuan, 1998). Nowadays, with the help of new technology such as communications network systems, concurrent engineering teams are able to communicate with potential suppliers and developing good supplier relationship (Abu Bakar, 2003) on the technical issues in a quick and systematic manner.

Effective concurrent engineering could improve manufacturing process such as reducing variation, relieving process bottlenecks, eliminating rework and managing capacity. By applying this approach, each company can reduce development time by as much as 30 to 50 percent. Concurrent engineering also requires that related departments provide inputs in the development stage on key important data from the previous models so that the stable information is available for the current model development. In other words, the development team is only working with the data, which is not likely to change. Otherwise, working with the early data will result in tremendous waste and require a longer duration. Thus, concurrent engineering will reduce product development time.

However, according to Maddux and Souder (1993), in any organization, two types of barriers are likely to exist in implementing concurrent engineering: organizational and technical. Organizational barriers may be the most difficult hurdle to overcome, since they involve delicate issues such as management style, policies, cultures, personnel behaviors and accustomed ways of doing things. On the other hand, technical barriers normally involve lack of facilitating technologies and know-how to implement the concept of concurrent engineering.

Computers have been and will continue to play a significant role for generating new technology especially in the manufacturing environment (Altiok, 1997). This statement was supported by Burgess et al (2003), who stated that the growth of computer applications in design, engineering and manufacturing has led to an explosion in the product volume. Most commonly used software are Computer Aided Design (CAD), Computer Aided Engineering (CAE), and Computer Aided Manufacturing (CAM). In concurrent engineering, the use and integration of all these IT tools have been accepted as a standard route. The electronic communication that links all these IT tools and other software tools between the personnel with the organization as well as the external communication between manufacturer and vendors could be carried out via File Transfer Protocol. File Transfer Protocol is one of the methods of data transfer from manufacturer to vendors or vice versa that helps improve or shorten product development timing.

Although there are different native file formats for the above software, data can be transferred to another computer system or software. According to Ogawa (1984), a flexible manufacturing system should integrate the use of Numerical Control (NC) tools, machining centers, and robots through computerization. Efstathiades (2002) also stressed that the adoption of advanced manufacturing technology gives a company a better position to enter new markets and to create new products compared to those relying on traditional manufacturing technology. Technology introduction is meant for cost reduction, increased flexibility, product quality and better managerial control.

Tailor Welded Blank (TWB) is one of the latest technologies in automotive component development process called stamping especially in reducing weight and cost for automotive industry. TWB is a concept of combining different steel properties and specifications into a welded blank. By using this concept, it enables the design engineer to tailor the blanks so that the steel's best properties are placed precisely within the part where they are needed.

This concept not only reduces the weight of the finished product, but also eliminates assembly process by means of reducing reinforcements. Significantly, according to the Institute for Advanced Engineering, South Korea (2001), TWB can help reduce parts, spot welds, manufacturing set-up, storage and time. At the moment, TWB is used for door inner panels, reinforcements, center pillars and wheelhousing.

Similar concepts that are proven to be the latest technological trend in automotive industry are Sashless Door and Front End Module. Sashless door is a concept of one piece stamping door including the upper frame of the door glass area. Previously, a glass frame, so called as sash is needed and welded together with the lower portion of the door to become a complete door. The traditional method requires roll forming for the sash and normally needs adjustment after it was assembled to the lower door due to welding distortion. Furthermore, the traditional method uses more assembly jigs, welding guns, and requires longer time. Most importantly, it is difficult to control the door quality. For Front End Module (FEM) approach, instead of using assembled parts to become a Front End component, it uses plastic moulding as a completed component. Normally, a FEM requires various different stamping parts to form a welded module. By using the stamping method, many dies need to be produced as well as welding stations. Therefore, lots of waste to the materials, tooling, and area which can be translated into higher cost and longer production timing. The above review provides a background for the study of methods used in automotive industry and these methods could be improved to reduce the development time of new models.

Methodology

This paper research starts with the study of current methods of car making processes by carrying out a literature review on the area of project management, operation management strategy, new technology and quality. The research focuses on how to maintain the original project timing and pertinent planning, which are linked to product quality. The scope of the study also includes project implementation by means of efficient operation and also to have a specific production strategy to tackle the focused market segments in order to increase profit.

Data on new car model project implementation program was collected based on the principal author's direct involvement in the project, project reports and group discussions. This data is very important because it represents the actual problems during the whole process of car making. Car making process involves people, methods, materials and machines throughout the product cycle. Since the project involves many different parties, problems are almost unavoidable but there should be room for improvements. The next stage of the study is to evaluate the data on the current practice that lead to the problems during the implementation stage. The evaluation is important because the factors that lead to the problems can be identified and it should be focused on 4M (Man, Method, Material and Machine) analysis. For the purpose of this paper, only the method element is considered. The evaluation of the existing project was carried out by interviewing the relevant personnel as well as through first hand experience and direct involvement of the principal author with the organization.

The final stage of the methodology is to review and analyze the current project implementation practice by comparing the existing methods and the proposed methods of project implementation tools and techniques. This is an important aspect of this research because the analyzed data determines whether the tools and techniques are viable to be implemented for a car making industry.

Analysis

Evaluation on the current practice focusing on method of executing tasks

This section describes the evaluation on the current practice which focuses on methods of carrying out important tasks. Project planning and master schedule were not officially endorsed by all related departmental heads, which resulted in too ambitious and unrealistic schedules. Moreover, market research was not comprehensive enough to gauge the car implementation timing, styling and manufacturing trend in the process of project planning. Benchmarking exercise was done on already released product and not for future products. The concurrent schedule was a good idea but implementation was not concurrent which resulted in timing over run.

It is found that progress monitoring and follow up were not according to helicopter view method whereby it only concentrated on individual party and no proper procedure for schedule revision. Thus, problems arised and information were not being shared at all levels the of related departments. Without proper control, a lot of data discrepancies found among project office, designers, manufacturing and vendors. It was quite troublesome if the vendors were from overseas and no proper follow-up to monitor their data accuracy and tooling progress. By applying the helicopter view method, all the activities can be monitored from a wider perspective including jobs integration, scheduling control and project monitoring

Vendor capacity and capability study were also not thoroughly audited to meet the volume plan. In addition, purchasing department took too long to appoint the suitable vendor to do the required job. The time taken by the purchasing department was not considered in the project master schedule, which affected the parts supplied by the vendors. The availability of parts were either delayed or the quality was not according to quality control's general dimension and tolerance set-up.

Review and analysis of current practice focusing on method improvement

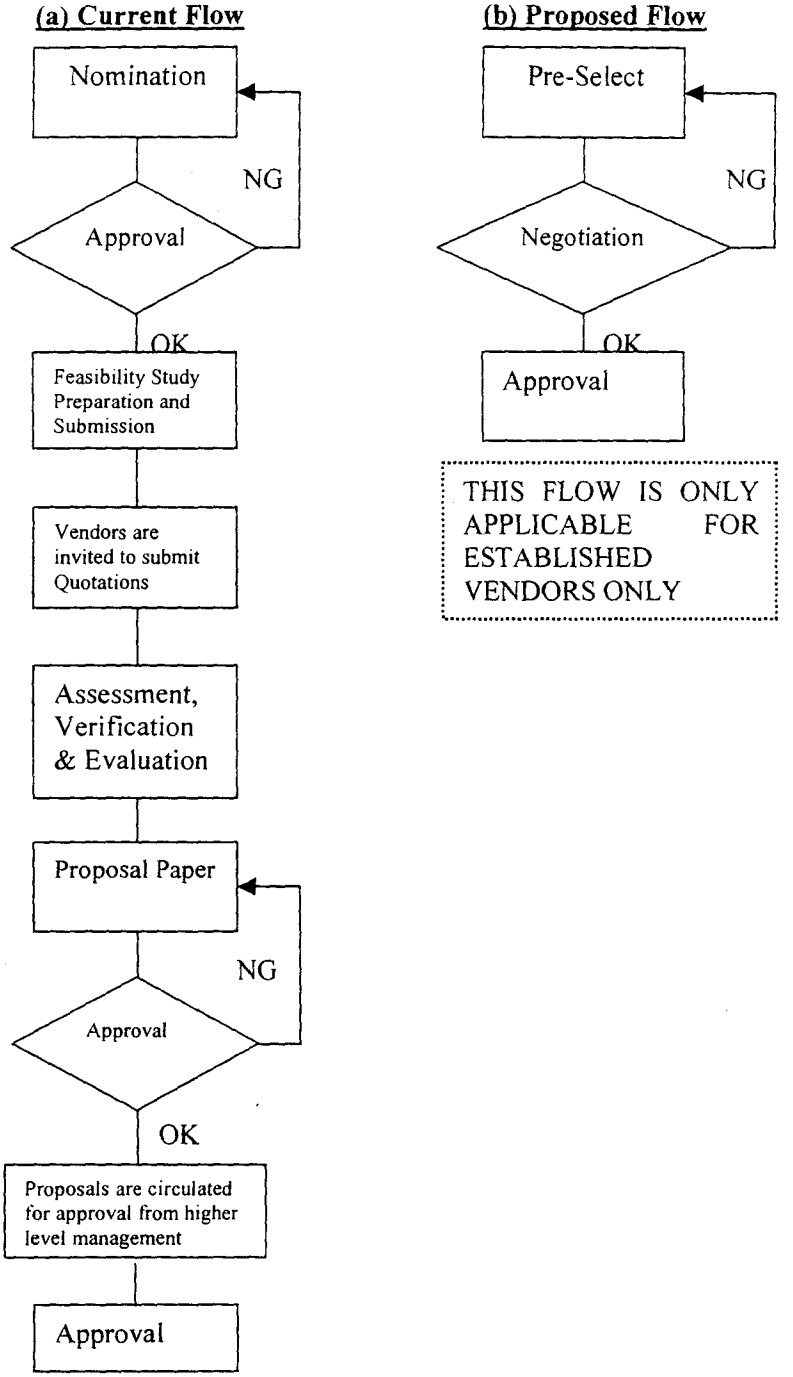
The current methods being practiced in the company are reviewed and analyzed in order to improve the project implementation program. Project planning and master schedule should be officially endorsed by all related departmental heads so that all the issues are considered. Among important issues that require attention in drafting the planning is market research and product benchmarking. Market research should consider the international motor shows, market trend, customer surveys and library research. Items to be considered for benchmarking should cover all aspects of new trend including styling, body concept, material, assembly method, engine and technology introduction. Therefore, research activities should not only be limited to research and development engineers but also engineers from all related parties including production engineers, safety engineers, maintenance engineers and sale and marketing engineers. These engineers should compile detail data of their research for design database and they must also be able to perceive future market trend based on the data analysis.

Once the master plan is concluded, it is left to the project manager to drive the activities in order to meet the master schedule. In addition, the project team should be allocated a specific room equipped with CAD terminals and Information and Communication Technology (ICT) devices for the permanent team to run the activities. In the project operation room, the master

schedule should be posted on the wall so that team members are aware of the progress of the project. This schedule needs to be updated by an appointed person once a week prior to coordination meeting. It is important that the representatives from each department are given the latest information on the progress of the project so that they can take necessary action to overcome any delay. Thus, problems and information are equally shared at all levels of related departments.

Purchasing strategy is one of the important areas that needs to be improved to meet the master schedule. Purchasing people should be in the project team so that they know the project's requirements and constrains throughout the project life especially for vendor's appointment (Abu Bakar and Rohaizat, 2002). Previously, the procedure was too complicated and time consuming which reflected the total project schedule. In the procedure as described in Figure 1(a), the current flow has to go through nomination, quotation, assessment, negotiation and approval processes. The procedure has to be followed by all vendors who wanted to participate in the project regardless of their status; either new or established vendors. Actually, this type of procedure should be improved and only applicable for new comers whereby no track record has been established (Harrington, 1987).

For the established vendors, only negotiation process is needed before the approval process (Figure 1(b)). This strategy is to cut the selection process timing as well as to have lower cost from the same vendor. Furthermore, the established vendors may have been familiar with the car manufacturer's tooling standards and specifications, and thus enables the vendors to develop the product at a shorter period. The other strategy to reduce cost is by giving the same part, such as door panel, to the same vendors. By giving the same part to the same vendor, it will reduce the tooling design time and is reflected in the cost because the vendor already has its design library from the previous projects. Figure 1 also shows the comparison of vendor selection flow for the current practice and the proposed flow, which clearly benefits manufacturer in terms of time saving and cost.



NG means no good

Figure 1: Vendor Selection Flow Comparison

Conclusions

From this study, it can be concluded that method improvement plays significant role in the development of a new car model. Among the issues that can be improved include the improvement in benchmarking practice, audit on vendor capability, availability of ICT facility, and comprehensive market research.

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